REMARKS

The remarks in this amendment are to address issues set forth in a rejection under 35 U.S.C. 112, second paragraph, and U.S.C. 103(a) that were made in the parent application. The present claims have been changed from the parent claims to put them in better form and to more clearly recite that which the applicant believes in the invention. In general, present claims 42-69, 71-83 correspond with parent claims 1-41. There has been no introduction of new matter. (See the Remarks, below.)

Parent Rejections under 35 U.S.C. 112, second paragraph

Claims 1-24, 27-32, 34-37 and 40-41 in the parent application were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner then alleged that the subject claims 1-24, 27-32, 34-37 and 40 - 41 were indefinite because the term "oxygen-ion conducting ceramic" is unclear.

"Oxygen-ion conducting ceramic" is a term that relates to the capability of an oxide to transport oxygen ions. This term is well known and the meaning well understood in the art. Evidence of this is shown by the attached exhibits, which show use of the term and its acceptance in the art. Exhibits A and B are articles (Christie, et al., "Microstructure - ....., and Yamamoto, et al. "Electrical conductivity .....) that refer to the use of oxygen-ion conducting ceramic materials used as ceramic electrolyte materials in solid oxide fuel cells. In these articles the measurement of electrical properties is made and a discussion of oxygen-ion conduction is made.

In addition, the following patents (copies enclosed) describe oxygen-ion conducting materials, and demonstrate that such are known in the art; (1) United States Patent 4,463,065 (col. 3, line 57 to col. 4, line 7, and claim 28, line 7), (2) United States Patent 4,674,321 (col. 2 lines 42 to 48, and claim 1, line 2), and (3) United States Patent 4,396,480 (col. 3, line 56 to col. 4, line 6, claim 1, line 9). These patent describe oxygen-ion conductors, which include, for example, ceramic materials that are solid solution electrolytes, such as calcia and yttria-stabilized zirconia. Their use in the claims also demonstrates the acceptance of this term as a well-known and clearly defined term.

Finally, attached as Exhibit C, is a Declaration from Denesh K. Shetty, that clearly demonstrates that this a clearly known and understood term.

The Examiner has also alleged that Claims 9, 19, and 21 to 23 in the parent application were indefinite because the term "stabilizer" is unclear. The term "stabilizer" as used in the art to which the present application pertains is clearly understood and known. Stabilizers are well known as materials that inhibit the transformation of a ceramic phase to a more thermodynamically stable phase. On page 4, at line 23 of specification, the nature and function of the stabilizers in the present invention is clearly stated, "The vapor may also contain one or more stabilizers to inhibit transformation of beta"-alumina to the beta-alumina." The term "stabilizer" is also shown in the same context of stabilizing beta"-alumina, to inhibit its transformation to beta-alumina, in (1) United States Patent 4,792,377 (col. 2, lines 6-8), and (3) United States Patent 5,496,513 (col. 2, lines 45 to 48), (copies enclosed). Please also note that beta"-alumina stabilizers are mentioned in the cited reference, Ichikawa et al., at col. 1, lines 31

to 37. These patents describe stabilizers for stabilizing beta"-alumina. Further, in the Declaration by Denesh Shetty (Exhibit C), it is sworn that the term, "stabilizer" is known and clearly defined in the art. It is well within knowledge of a practitioner at the time of the present invention to clearly identify a stabilizer to prevent such a transformation.

The Applicants believe that the terms "oxygen-conducting" and "stabilizer" in the context of the present application are well understood terms in the art, and these terms are definite and clear and the claims meet the requirements of 35 U.S.C. 112, second paragraph. Accordingly, the Examiner is requested to reconsider and withdraw this rejection.

Parent Rejection under 35 U.S.C. 103(a) - Chiku et al.

Claims 29 to 38 of the parent application were rejected under 35 U.S.C. 103(a) as being unpatentable over Chiku et al. (589). Chiku et al. teaches formation of beta-alumina using a vapor produced from a powder containing sodium oxide and zirconium oxide. It was Examiner's contention that Zr component will be present in the vapor and will become part of the final sodium beta alumina ceramic, as an oxide therefore. Contrary to the allegations of the Examiner, a composite of beta-alumina oxide and zirconium oxide cannot be formed by the Chiku et al. process. As further discussed in the Declaration of Denesh Shetty in Exhibit C, the vapor pressure of zirconium oxide is much less than that of sodium oxide, thus there would be very little, if any, zirconium in the vapor. This is shown in particularly by comparing vapor pressures of zirconium oxide and sodium oxide. For zirconium oxide the vapor pressure is 3×10^{-28} atm. (for ZrO_2 at 1100°K), which is several order of magnitude smaller than that for sodium, which is 2×10^{-7} atm. (for NaO and Na at 1100°K). Clearly, with the vapor pressure of zirconium oxide

being so small in relation to sodium oxide, only a miniscule amount of zirconium oxide could exist in the vapor of Chiku et al. Clearly, there would be insufficient zirconium in the vapor to form a zirconium continuous phase in a composite as recited by the present claims, for to create a continuous phase, among other conditions, the zirconium would have to be present as a significant fraction in the vapor.

As recited in the claims, the present invention involves continuous phases of metal-ion and oxygen-ion conductors, both of which must be continuous to provide conduction paths. Such continuity of both phases cannot be formed by a Chiku et al. process or any process similar thereto. Since anything similar to the present invention cannot be formed by the Chiku et al. reference, the present invention cannot be suggested by this reference. Accordingly, the Examiner is requested to allow the claims over Chiku et al.

Parent Rejection under 35 U.S.C. 103(a) - Ichikawa et al.

Claims 29 to 38 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Ichikawa et al. Ichikawa et al. teaches a composite of beta alumina, sodium oxide, and zirconium oxide. This reference does not suggest the present invention. As recited in the claims, the phases of both the metal -ion conductor, which may beta-alumina and the oxygen-ion conductor, which may be zirconia, must be continuous through the composite. As further discussed in the Declaration of Denesh Sheet, Exhibit C, there is no disclosure in Ichikawa et al. of any phase being continuous, much less both phases. Continuity of both phases requires a deliberate control of the manufacturing conditions. Teachings that would suggest or disclose a continuous phase are not found in Ishikawa et al.

The concentration of zirconium oxide in the Ichikawa et al composites is between 0.1 and 2 wt.%. The zirconium oxide is added to widen the range of sintering temperature, and in the amount given would be insufficient to form a continuous phase of zirconium oxide. There is specific teaching against any larger amount of zirconium oxide @greater that 2 wt.%, which larger amount would be required to form a continuous phase (col. 3, line 63, to col. 4, line7). Thus, Ichikawa et al. teaches against the concentration required to form a continuous phase of zirconium oxide.

For the sake of argument, even if a composite made according to the teachings of Ishikawa et al. may inadvertently have both phases continuous, such an event would be unlikely. In addition, if such did occur, the continuous phases of the composite would be unrecognized, and any advantages that may come about by both phases being continuous would be totally unrecognized, since there is no suggestion by Ishikawa et al. that would lead the practitioner to such a recognition. Accordingly, there can be no suggestion of a composite, as in the present invention, where both the oxygen-ion and metal-ion phases are continuous to provide respective paths of conductivity through the composite.

It is believed that the present invention is not suggested by Ishikawa et al. Accordingly, the Examiner is respectfully requested to allow the claims over Ishikawa et al.

SUMMARY

The Applicants believe that the present invention, as recited in the claims, is patentable over the cited references and that it description and claims as amended meet the formal

requirements required for allowance of the present application. Accordingly, the Examiner is respectfully requested allow the present claims.

Respectfully submitted;

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James L. Sonntag
Reg. No. 30,224